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Patent claims

1. A reflectance sensor, built up from

a) an optical unit (A) which comprises

aa) a light source (Aa) in the form of a lamp, and

ab) a fiber-optic system comprising optical waveguides (Ab), at least one optical waveguide being a reference waveguide,

b) a sample analysis unit (B), which comprises

ba) a measuring window (Ba), and

bb) a sample analysis cell (Bb),

the optical unit being arranged on one side of the measuring window and the sample analysis cell being arranged on the other side of the measuring window, by said cell being pressed against the measuring window in such a way that, between measuring window and sample analysis cell, a gap is formed which must be traversed by a sample to be measured in the form of a liquid pigment preparation, the sample being sheared considerably as it traverses the gap,

and

c) a system control unit (C) comprising detectors (Ca) for recording measured data and an evaluation device (Cb) connected thereto,

at least one optical waveguide connection being led from the light source (Aa) to the measuring window (Ba) and from the measuring window (Ba) onward to the detector (Ca), to generate a measured signal (reflectance of product), and at least one reference waveguide connection being led

directly from the light source (Aa) to the detector (Ca) or from the measuring window (Ba) to the detector (Ca) to produce a reference signal.

2. A reflectance sensor, built up from:

a) an optical unit (A) which comprises

aa) a light source (Aa) in the form of a lamp, and

ab) a fiber-optic system comprising optical waveguides (Ab), at least one optical waveguide being a reference waveguide,

b) a sample analysis unit (B'), which comprises

b'a) a measuring window (B'a), and

b'b) a holder for samples which have a solid surface (B'b),

and

c) a system control unit (C) comprising detectors (Ca) for recording measured data and an evaluation device (Cb) connected thereto,

an optical waveguide connection being led from the light source (Aa) to the measuring window (B'a) and from the measuring window (B'a) onward to the detector (Ca), to generate a measured signal, and a reference waveguide connection being led directly from the light source (Aa) to the detector (Ca) or from the measuring window (B'a) to the detector (Ca) to produce a reference signal.

3. The reflectance sensor as claimed in claim 1 or 2, wherein the lamp is chosen from the group comprising LEDs, gas discharge lamps and lamps with incandescent filaments.

4. The reflectance sensor as claimed in one of claims 1 to 3, wherein the lamp has an integrated shutter.

5. The reflectance sensor as claimed in one of claims 1 to 4, wherein the optical waveguides are fibers of 100, 200, 400, 600 or 800 μm fiber diameter.

6. The reflectance sensor as claimed in one of claims 1 to 5, wherein the fiber used as a reference waveguide has a diameter matched to, preferably smaller than, the remaining optical waveguides.

7. The reflectance sensor as claimed in one of claims 1 to 6, which additionally has at least one of the following features:

ac) arranged behind the lamp is a compensation filter, which linearizes the spectrum from the lamp such that the difference between the highest and lowest intensity of the light emitted by the lamp is as small as possible, for example at most a factor 4,

ad) an IR blocking filter, a condenser and a scattering disk are arranged behind the lamp - between lamp and compensation filter if a compensation filter is used,

ae) the optical waveguides are led in protective tubes and supported over their entire length by means of a supporting frame,

af) the reference waveguide is led via a precise spacing element with incorporated scattering disk, and attenuated in a defined manner.

8. The reflectance sensor as claimed in one of claims 1 to 7, wherein the measuring window is a plane plate, preferably a plane plate of glass, semi-precious stones or diamond, particularly preferably 1 to 12 mm thick and 10 to 80 mm diameter.

9. The reflectance sensor as claimed in one of claims 1 or 3 to 8, wherein the gap is 2 to 15 mm long, 2 to 40 mm wide and between 0.05 and 5 mm high, the exact height preferably being variably adjustable.

10. The reflectance sensor as claimed in one of claims 1 or 3 to 9, wherein the considerable shearing of the sample is achieved by a pressure drop in the gap from

the entry point of the sample into the gap as far as its exit point of 0.1 to 3 bar over 1 to 15 mm length, preferably 0.5 to 1 bar over 1 to 5 mm length.

11. The reflectance sensor as claimed in one of claims 1 or 3 to 10, wherein the sample analysis cell (Bb) is removable.

12. The reflectance sensor as claimed one of claims 2 to 8, wherein the holder for samples which have a solid surface (B'b) is formed by guide rods, the samples being pressed against the measuring window by a pressure element and sprung by means of a spring element.

13. The reflectance sensor as claimed in one of claims 1 to 12, wherein the system control unit has detectors in the form of fiber-optic monolithic diode-line sensors which permit a resolution of at least 15 bits.

14. The reflectance sensor as claimed in one of claims 1 to 13, wherein all the units of the reflectance sensor are accommodated in a common housing, in which ventilation and thermostat-controlled heat dissipation are carried out.

15. A method of measuring the reflectance of a sample in the form of a liquid pigment preparation, comprising:

i) forming a sample stream with a defined thickness,

ii) irradiating the sample stream with electromagnetic radiation emitted by a light source, the electromagnetic radiation interacting with the sample and some of the radiation being reflected diffusely following interaction with the sample,

iii) receiving and registering the diffusely reflected radiation as a reflectance signal,

iv) receiving and registering a reference signal, the reference signal being electromagnetic radiation emitted by the same light source which serves to irradiate the sample stream but which does not interact with the sample,

the reflectance signal and the reference signal being registered simultaneously.

16. The use of a reflectance sensor as claimed in one of claims 1, 3 to 11, 13 or 14 for measuring the reflectance of a sample in the form of a liquid pigment preparation.

17. The use of a reflectance sensor as claimed in one of claims 1, 3 to 11, 13 or 14 for measuring the reflectance of liquid pigment preparations in any desired process stage in the production, further processing and the use of liquid pigment preparations, preferably for quality control during the dispersion of pigmented coatings and pigment pastes, for quality assessment during coating production, for controlling a metering system during the formulation of coatings by mixing various liquids, for automatically controlled color adjustment by means of tinting during coating production, for matching the color of the coating in a coating system which has a metering system for colored pastes and/or for monitoring subsequent color changes as a result of ageing or shear stressing of pigmented coatings or pigment pastes.

18. The use of a reflectance sensor as claimed in one of claims 1, 3 to 11, 13 or 14 to carry out a method as claimed in claim 15.

19. The use of a reflectance sensor as claimed in one of claims 2 to 8 or 12 to 14 for measuring the reflectance of a sample which has a solid pigmented surface, preferably a metal sheet or a film.